

evidence in response to the Final Rejections and the Examiner's assertions of fact in support thereof. In light of this evidence, reconsideration and withdrawal of the Final Rejections are earnestly requested.

Also submitted herewith is Applicant's Petition for Extension of Time of two months and the required fee.

### Oath/Declaration

The Examiner requires a new oath or declaration on the grounds that the declaration, as filed, contained non-initialed alterations. Applicant hereby acknowledges the requirement for a new declaration.

Because one of the co-inventors, Venanzio DiTullio, died subsequent to filing the application, Applicant's attorney currently is seeking the Representative of Decedent's Estate for execution of the new declaration, as specified in 37 C.F.R. 1.42-1.47, and 37 C.F.R. 1.423, MPEP § 409.01 - § 409.03(j). Therefore, it is respectfully requested that the requirement for a new declaration be withdrawn or held in abeyance, until a Notice of Allowance is issued.

### Rejections under 35 U.S.C. § 112

Claims 1-38 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. More particularly, the Examiner maintains that in claim 1 step (c), "it is unclear what - whether product or something else - amines are." Applicant respectfully disagrees with the rejection.

It is respectfully submitted that the language of claim 1 is clear on its face. More particularly, claim 1 clearly recites that "said organic material (*i.e.*, **raw input material**) is **chemically transformed into a mixture comprising ..... and, (when protein or other nitrogenous compounds are present in said organic material,) amines.**" Thus, it is clear that, as recited in claim 1, if protein or other nitrogenous compounds are present in the input material, then amines are part of the mixture that is a product of the chemical transformation. The amines limitation of claim 1 is not reasonably susceptible to any other interpretation, therefore, it cannot be indefinite. Statement 7 of the submitted Declaration concurs with this explanation. It is respectfully submitted that the rejection is thus overcome, and that there are no ambiguities in the

claim. Reconsideration and withdrawal of the indefiniteness rejection of claim 1, in light of the submitted Declaration, are respectfully requested.

Dependent claims 2-38, being dependent upon and further limiting independent claim 1, should also be allowable for that reason, as well as for the additional limitations recited therein. Reconsideration and withdrawal of the indefiniteness rejection of claims 1-38 are therefore respectfully requested.

Claim 4: The Examiner states that "Claim 4 is non-sense since it is unclear why "hydrolysis and decarboxylation occur at a temperature of about 200-430°C" is recited in the claim. There are no relationship between these reactions with the reaction in claim 1 recited in the claim. Further, it is unclear where these two reactions occur." To the extent that Applicant understands the rejection, Applicant respectfully disagrees.

It is respectfully submitted that the language of claim 4, when read in light of the specification, is clear and unambiguous. More particularly, regarding the **relationship between the chemical transformation** recited in step (c) of claim 1 **and the additional recitation of hydrolysis and decarboxylation reactions** in dependent claim 4 (and the reason for that additional recitation): claim 4 is a dependent claim and therefore recites an additional feature (*i.e.*, hydrolysis and decarboxylation), as well as the features of independent claim 1, from which it depends (as is required of any dependent claim). Further, the specification clearly describes the **relationship** between the hydrolysis and decarboxylation reactions of claim 4 and the point at which (*i.e.*, "**where**") they occur during the chemical transformation recited in claim 1:

"It is known in the prior art that classic organic reactions involving these constituents, such as hydrolysis, bond cleavage and bond formation, occur in the sub-critical zone, as described in U.S. Patent No. 4,515,713, and at or above the super-critical temperature of water. *See, e.g., Kuhlmann et al., J. Org. Chem.* 59: 3098-3101 (1994); C.R. Strauss, *Aust. J. Chem.* 52: 83-96 (1999). For example, hydrolysis of esters, thioesters and amides occurs in SCW, and is usually accompanied by decarboxylation. *See, e.g., U.S. Patents No. 5,344,975, No. 5,329,054, and No. 5,630,854, which teach the use of acidic, basic and*

neutral catalysts, respectively, in such reactions." Specification page 2, lines 15-23.

and: "Hydrolysis of the proteins produces a mixture of amino acids; hydrolysis of the triglycerides and lipids produces a mixture of C<sub>4</sub> to C<sub>24</sub> carboxylic acids, plus glycerol. Decarboxylation of the amino acids and the carboxylic acids generate fractionally distillable carbon dioxide, amines, and C<sub>3</sub> to C<sub>23</sub> hydrocarbons." Specification page 5, lines 7-10; see also the numerous Examples, which detail the points at which hydrolysis and decarboxylation occur.

Thus, hydrolysis and decarboxylation clearly occur during the claimed process, particularly during steps (b) and (c) of claim 1. The language of claim 4 is not reasonably susceptible to any other interpretation, therefore, it cannot be indefinite. Statement 8 of the submitted Declaration concurs with this explanation. It is respectfully submitted that the rejection is thus overcome, and that there are no ambiguities in the claim. Reconsideration and withdrawal of the indefiniteness rejection of claim 4, in light of the submitted Declaration, are therefore respectfully requested.

Claim 7: The Examiner states that "The examiner cannot understand what applicants intend to claim in claim 7. It is unclear what the meaning of simultaneously, independently, in concert or in cascade fashion is." Applicant respectfully disagrees with the rejection.

The standard for indefiniteness is whether one of ordinary skill in the art would understand the meaning of the claims. Absent a specific definition in the specification, claim terms are given their plain, ordinary meaning. The terms "simultaneously, independently, in concert or in cascade fashion" are common terms that are well known in the art and would be understood by one of ordinary skill in the art to have their plain, ordinary meaning. The language of claim 7 is not reasonably susceptible to more than one interpretation, therefore, it cannot be indefinite. Statement 9 of the submitted Declaration concurs with this explanation. It is respectfully submitted that the rejection is thus overcome, and that there are no ambiguities in the claim. Reconsideration and withdrawal of the indefiniteness rejection of claim 7, in light of the submitted Declaration, are therefore respectfully requested.

Claim 11: The Examiner states that it is unclear what the **"inorganic phase" and "metals-tars-organosulfur contaminants"** are and from which they come. Applicant respectfully disagrees.

The terms "inorganic phase" and "metals-tars-organosulfur contaminants" are well known in the art and would be understood by one of ordinary skill in the art to have their plain, ordinary meaning. The language of claim 11 is not reasonably susceptible to more than one interpretation, therefore, it cannot be indefinite. Statement 10 of the submitted Declaration concurs with this explanation. It is respectfully submitted that the rejection is thus overcome, and that there are no ambiguities in the claim. Reconsideration and withdrawal of the indefiniteness rejection of claim 11, in light of the submitted Declaration, are therefore respectfully requested.

Claim 14: The Examiner states that **"any similar organic matter, which is suitable for use in said catalytic reduction process"** is indefinite since it is unclear which matters are and how to know it is suitable.

It is respectfully submitted that, read in light of the specification, one of ordinary skill in the art would understand the types of organic matter that are suitable, particularly based on the range of input materials described in the Examples. The language of claim 14 is not reasonably susceptible to more than one interpretation. Therefore, it cannot be indefinite. Statement 11 of the submitted Declaration concurs with this explanation. It is respectfully submitted that the rejection is thus overcome, and that there are no ambiguities in the claim. Reconsideration and withdrawal of the indefiniteness rejection of claim 14, in light of the submitted Declaration, are therefore respectfully requested.

Claim 21: The Examiner states that **"The examiner cannot understand claim 21."**

The standard for indefiniteness is whether one of ordinary skill in the art would understand the meaning of the claims. Absent a specific definition in the specification, claim terms are given their plain, ordinary meaning. It is respectfully submitted that the language of claim 21 is clear on its face, and it is not reasonably susceptible to more than one interpretation, therefore, it cannot be indefinite. Statement 12 of the submitted Declaration concurs with this

explanation. It is respectfully submitted that the rejection is thus overcome, and that there are no ambiguities in the claim. Reconsideration and withdrawal of the indefiniteness rejection of claim 21, in light of the submitted Declaration, are respectfully requested.

Claim 23: The Examiner states that it is unclear which ones are hydrolyzed into acids, alcohol, and amines.

Claim 23-38: Further, the Examiner states that "Claims 23-38 are nonsense since it is unclear [whether] the limitations of these claims are required in the process or not. For examples (sic) in claim 23, it is unclear if plastics or protein which contains amides are present in the organic material or not. If so, claim 25 does have any meaning." To the extent that Applicant understands the rejection, Applicant respectfully disagrees.

It is respectfully submitted that the language of claim 23 is clear on its face, and it is not reasonably susceptible to more than one interpretation, therefore, it cannot be indefinite. Statement 12 of the submitted Declaration concurs with this explanation. It is respectfully submitted that the rejection is thus overcome, and that there are no ambiguities in the claim. Reconsideration and withdrawal of the indefiniteness rejection of claim 23, in light of the submitted Declaration, are respectfully requested.

Dependent claims 24-30, being dependent upon and further limiting claim 23, should also be allowable for the reasons given above and in light of statement 14 of the submitted Declaration, as well as for the additional limitations recited therein. Reconsideration and withdrawal of the indefiniteness rejection of claims 1-38 are therefore respectfully requested.

Applicant believes that these comments have fully addressed the Examiner's rejections, that there are no ambiguities in the claims, and the claims are in condition for allowance. Reconsideration and withdrawal of the indefiniteness rejection of claims 1-38, in light of statements 7-15 and 21 of the submitted Declaration, are therefore respectfully requested.

#### **Rejections under 35 U.S.C. §103**

Claims 1-11 and 14-38 were rejected under 35 U.S.C. § 103 (a) as being unpatentable over *Lee et al.* (5,386,055). Applicant respectfully disagrees with the rejection.

Applicant's claim 1 recites, *inter alia*, a chemical process for the **catalytic reduction of raw organic materials**. Lee *et al.* does not teach or suggest a chemical process for the catalytic reduction of raw organic materials. Rather, Lee merely teaches **oxidation of synthetic polymers** (*i.e.*, synthetic polymers are not raw organic materials, rather, they are highly processed synthetic compounds). Therefore, the prior art does not teach each and every element of the claimed invention. Further, the Examiner has not identified any teaching or suggestion in the prior art that Lee should be modified from an oxidation process to Applicant's reduction process. The only such suggestion of record comes from Applicant's disclosure. Statements 17 and 18 of the submitted Declaration concur with this explanation. It is respectfully submitted that the rejection is thus overcome. Reconsideration and withdrawal of the obviousness rejection of claim 1, in light of the submitted Declaration, are therefore respectfully requested.

Dependent claims 2-11 and 14-38, being dependent upon and further limiting independent claim 1, should also be allowable for that reason, as well as for the additional limitations recited therein. Reconsideration and withdrawal of the obviousness rejection of claims 1-38 are therefore respectfully requested.

Claim 12 was rejected under 35 U.S.C. § 103 (a) as being unpatentable over Lee *et al.* (5,386,055) in view of Diaz *et al.* (4,478,612).

Applicant respectfully disagrees with the rejection, and believes that claim 12 is patentable over Lee *et al.* (5,386,055) in view of Diaz *et al.* (4,478,612), both individually and in combination, for the reasons given above in respect to the section 103 rejection of claim 1, from which claim 12 depends. The argument above as to the non-obviousness of claim 1 is repeated here by reference; Diaz does not cure the deficiencies of Lee. The combination of Lee and Diaz would merely result in a process involving **oxidation of synthetic polymers** using glycerol as a desiccant, which clearly does not teach or suggest Applicant's claimed process for the **catalytic reduction of raw organic materials**. Statements 17-19 of the submitted Declaration concur with this explanation. It is respectfully submitted that the rejection is thus overcome. Reconsideration and withdrawal of the obviousness rejection of claim 12, in light of the submitted Declaration, are therefore respectfully requested.

Claims 13 and 28 were rejected under 35 U.S.C. § 103 (a) as being unpatentable over Lee *et al.* (5,386,055) in view of Lin *et al.* (EP 1002767).

Applicant respectfully disagrees with the rejection, and believes that claims 13 and 28 are patentable over Lee *et al.* (5,386,055) in view of Lin *et al.* (EP 1002767), both individually and in combination, for the reasons given above in respect to the section 103 rejection of claim 1, from which claims 13 and 28 depend. The argument above as to the non-obviousness of claim 1 is repeated here by reference; Lin does not cure the deficiencies of Lee. The combination of Lee and Lin would merely result in a process involving oxidation of synthetic polymers using lime to absorb carbon dioxide, which clearly does not teach or suggest Applicant's claimed process for the catalytic reduction of raw organic materials. Statements 17, 18, and 20 of the submitted Declaration concur with this explanation. It is respectfully submitted that the rejection is thus overcome. Reconsideration and withdrawal of the obviousness rejection of claims 13 and 28, in light of the submitted Declaration, are therefore respectfully requested.

Applicant believes that these comments and the submitted Declaration have fully addressed the Examiner's rejections, that there is no obviousness in the claims, and the claims are in condition for allowance. Reconsideration and withdrawal of the obviousness rejection of claims 1-38, in light of statements 16-21 of the submitted Declaration, are therefore respectfully requested.

### Conclusion

Applicant believes the claims are patentable over the prior art, and that this case is now in condition for allowance of all claims therein. Such action is thus respectfully requested. If the Examiner disagrees, or believes for any other reason that direct contact with Applicants' attorney would advance the prosecution of the case to finality, he is invited to telephone the undersigned at the number given below.

"Recognizing that Internet communications are not secured, I hereby authorize the PTO to communicate with me concerning any subject matter of this application by electronic mail. I understand that a copy of these communications will be made of record in the application file."

Respectfully Submitted:

--DiTullio et al.--

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## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

November 24, 2003

Serial No. 09/934,318  
Applicant: DiTullio *et al.*  
Filed: 08/21/01  
Title: **A DENDRITIC PROCESS FOR THE CATALYTIC  
REDUCTION OF HEAVY OILS, KEROGENS, PLASTICS,  
BIO-MASSSES, SLUDGES AND ORGANIC WASTES TO  
LIGHT HYDROCARBON LIQUIDS, CARBON DIOXIDE AND  
AMINES**  
Art Unit: 1764  
Examiner: Thuan D. Dang  
Confirmation Number: 7989  
  
Attorney Docket No.: DSE-2

HONORABLE COMMISSIONER OF PATENTS  
Washington, D.C. 20231

## DECLARATION UNDER 37 CFR § 1.132

In response to the Office Action dated June 30, 2003, I, Dr. Kraig L. Haverstick, Ph.D., hereby declare and say as follows:

## BACKGROUND INFORMATION

1. I recently completed a term as a Research Associate in the School of Chemical and Biomolecular Engineering at Cornell University. My *curriculum vitae*, which describes my education, employment, research publications and other expert qualifications, is **attached hereto as Exhibit 1**.
2. I have extensive training in the relevant fields of organic chemistry, chemical process design, and chemical reactor engineering. I have been trained in the field of chemical engineering and have worked in the field since 1999. Through my years of study and research, I am familiar with the skills of those currently working in the field.
3. I have read and understood the above referenced patent application, including the specification and claims. I have also read and understood U.S. Patent No. 5,386,055 to Lee *et al.*, U.S. Patent No. 4,478,612 to Diaz *et al.*, and European Patent No. 1002767 to Lin *et al.*, cited by the Examiner in this case in support of the obviousness rejections of the claims.

Based on my analysis of the contents of the aforementioned documents, I have formulated certain opinions regarding the issues of definiteness and obviousness of the claims.

4. The standard I used for definiteness is whether one of ordinary skill in the art would understand the meaning of the claim language and the scope of the claims.
5. The standard I used for obviousness is whether the differences between the subject matter sought to be patented and the prior art are such that the claimed subject matter as a whole would have been obvious, at the time the invention was made, to a person having ordinary skill in the art of chemical reactor/process engineering, and whether the teaching or suggestion is accompanied by an expectation of successfully making the claimed subject matter.
6. A person of ordinary skill in the art would have a Ph.D. in chemical engineering, biochemical engineering, or an equivalent degree and at least two years of laboratory research experience in reactor engineering, or at least a B.S. degree and a minimum of four years of laboratory research experience in chemical reactor engineering.

#### CLAIMS 1-38 ARE NOT INDEFINITE

7. The amines mentioned in step (c) of claim 1 are clearly reaction products, which form "when protein or other nitrogenous compounds are present" in the feed stream.
8. Claim 4 is directly related to claim 1 in that it describes two of the ways in which "the organic material is chemically transformed" and broken down into lower molecular-weight molecules in the chemical process. These two types of chemical reactions clearly must occur within the "single reaction zone" that is introduced in claim 1, step (d). These reactions occur within the conditions given for the reactor of claim 1, step (c).
9. What the inventors are claiming is a process in which decomposition reactions occur in diverse ways and orders. There will be many different reactions occurring simultaneously in the process. Some will occur independently (i.e. without a catalyst). Reactions may occur in parallel (simultaneous) or in series (cascade). The terms simultaneously, independently, in concert, and in cascade would be understood by one of ordinary skill in the art.
10. The terms "inorganic phase" and "metals-tars-organo-sulfur contaminants" would be understood by anyone skilled in the art. Collectively, these are the solids or particulate matter

than would settle out of the product stream. The process is intended for very crude feed streams, which explains why such contaminants would be present.

11. Item (n) of claim 14 is not indefinite, in that one skilled in the art would know if a given organic material would be amenable to this process. It would clearly need to be of a state that it could be fed to the reactor directly or upon dilution with water. It would also need to be composed primarily of "organic" molecules or polymers whose bonds could be broken down under the reaction conditions of the process.
12. Claim 21 and claim 22 are closely related and are understandable to one of ordinary skill in the art. Both address the ability of the catalytic reduction process to reduce the viscosity of the feed stream by breaking up large organic molecules into smaller ones.
13. In claim 23, the hydrolysis products named as "acids, alcohols, and amines" are products of reactions, not of compounds *per se*. An amide group hydrolyzes into an acid and an amine. An ester group hydrolyzes into an acid and an alcohol. One skilled in the art would know that acids and amines are produced by hydrolysis of plastics or proteins, acids and alcohols come from polyesters, triglycerides and lipids, and all three groups would be generated from resins. A figure showing all of the relevant reaction types in this chemical process would help to clarify the process, but the reaction types are all included in the detailed description of the invention. Please see, for example, page 7, lines 28-31; page 11, lines 7-9; page 13, lines 18-20; and page 15, lines 6-8.
14. Dependent claims 23-38 describe the desired reactions which will occur during the catalytic reduction process, the steps necessary to extract useful components from the product stream, and the measures which will allow waste products to be processed. Amines clearly play a critical role in catalysis and must be present: either added to the feed stream or already present in the organic matter. Please see, for example, page 4, lines 27-28 and page 5, lines 10-11, lines 24-25.
15. Upon reading the detailed description and claims of the invention at issue, one who is skilled in the art would be able to practice the described "dendritic process for the catalytic reduction of heavy oils, kerogens, plastics, bio-masses, sludges and organic wastes to light hydrocarbon liquids, carbon dioxide and amines" without undue experimentation.

#### NON-OBVIOUSNESS OF CLAIMS 1-38

16. The Examiner maintains that claims 1-11 and 14-38 are obvious over Lee. I strongly disagree with the Examiner's conclusion of obviousness, and particularly disagree with the Examiner's assertion that one of ordinary skill in the art would have a reasonable expectation of success in making the claimed invention, as the Examiner's conclusion is not supported by the evidence and, in fact, it is incorrect, as explained in further detail below.
17. First and foremost, Lee *et al.* describes an oxidative process, whereas the current process is a reductive one. Although oxidation and reduction are related processes, they are different.
18. The disclosure and claims of Lee strictly limit their process to degradation of a synthetic polymer for recovery of the monomer units for reuse. Although many different polymers are indicated as amenable to this process, there is no indication that more than one polymer type can be simultaneously introduced in the feed stream. No teaching is provided for applicability to natural, organic, or mixed input streams or for the production or collection of produced hydrocarbons. It would not be obvious to one of ordinary skill in the art to modify the Lee *et al.* invention for the current process.
19. Lee does not address the issue of how to deal with carbon dioxide production from their process. Therefore, it can not be obvious to apply Diaz's process for collecting carbon dioxide using glycerol to Lee's process. Claim 12 is not obvious over Lee and Diaz. The produced carbon dioxide will be under supercritical conditions in the reactor and its removal is not required to maintain pressure as the examiner argues.
20. For the same reasons as 19, it is not obvious to apply Lin's method of using lime water to remove carbon dioxide. Claims 13 and 28 are not obvious over Lee and Lin.

### CONCLUSION

21. Based on the above analysis, I conclude that the claims in the present patent application are enabled and both novel and non-obvious over the prior art.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated: 11/24/03

By: Kraig L. Haverstick  
Dr. Kraig L. Haverstick, Ph.D.

# Kraig Haverstick

## *Curriculum Vitae*

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### Research Associate

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### Education

February, 1999 **University of Minnesota**, Minneapolis, MN GPA 3.25  
**Ph.D. Degree** Chemical Engineering GPA in Major 3.43  
"Fundamental Behavior of a Model Biomolecular Amphiphile System"

May, 1993 **University of Rochester**, Rochester, NY GPA 3.82  
**BS Degree** Chemical Engineering GPA in Major 3.84  
Graduated with **Highest Distinction**  
**Minor** in Philosophy – College of Arts and Sciences

### Postdoctoral Training

September 1999-September 2002 **Cornell University**, Ithaca, NY  
School of Chemical and Biomolecular Engineering, Dr. W. Mark Saltzman  
Drug Delivery of Chemotherapy Agents in the Brain

February 1999-September 1999 **Lehigh University**, Bethlehem, PA  
Department of Chemistry, Dr. Steven Regen  
Transmembrane Delivery to Cells using Novel Molecular Umbrellas

### Publications

Schneider, J., Berndt, P., Haverstick, K., Kumar, S., Chiruvolu, S., and Tirrell, M. (1998) Force and Adhesion Measurements Between Hydrogen-Bonded Layers of Glycine-Functionalized Amphiphiles. *J. Am. Chem. Soc.* **120**, 3508.

Pakalns, T., Haverstick, K.L., Fields, G.B., McCarthy, J.B., Mooradian, D.L., and Tirrell, M. (1999) Cellular Recognition of Synthetic Peptide Amphiphiles in Self-Assembled Monolayer Films. *Biomaterials* **20**, 2265-2279.

## Kraig Haverstick

Schneider, J., Dori, Y., Haverstick, K., Tirrell, M., and Sharma, R. (2002) Force Titration of Langmuir-Blodgett Bilayers of Glycine Amphiphiles: JKR-type Measurements using the Surface-Force Apparatus. *Langmuir* 18, 2702-2709.

Luo, D., Haverstick, K., Belcheva, N., Han, E., and Saltzman, W.M. (2002) Poly(ethylene glycol)-Conjugated PAMAM Dendrimer for Biocompatible, High-Efficiency DNA Delivery. *Macromolecules* 35, 3456-3462.

Schneider J., Berndt P., Haverstick K., Kumar S., Chiruvolu S., Tirrell M. (2002) Surface Force Measurements of Electrostatic and Hydrogen-Bonding Interactions between Bilayers of Glycine Amphiphiles. *Langmuir* 18, 3923-3931.

Haverstick, K., Fleming, A., and Saltzman, W.M. (2003) Conjugation to Increase the Treatment Volume during Local Therapy: A Case Study with PEGylated Camptothecin. Submitted to *Bioconjugate Chemistry*.

### Podium Presentations

Advances in Controlled Delivery Conference, Controlled Release Society, 20 August 1996, Baltimore, MD

23<sup>rd</sup> Annual Meeting, Society for Biomaterials, 3 May 1997, New Orleans, LA

Haverstick, K., Pakalns, T., Yu, Y.C., McCarthy, J.B., Fields, G.B., and Tirrell M., "Targeted Cell Interactions with Surfaces Incorporating Synthetic Peptide Amphiphiles," and Haverstick, K., Berndt, P., Schneider, J., Pakalns, T., Dori, Y., Tirrell, M. "Design of a Peptide Amphiphile for Cell Adhesion," 214<sup>th</sup> National American Chemical Society Meeting, 11 September 1997, Las Vegas, NV

1997 American Institute of Chemical Engineers Annual Meeting, 17 November 1997, Los Angeles, CA

### Awards

1990 CRC Press Freshman Chemistry Achievement Award, Outstanding Junior in Chemical Engineering, Graduate School Fellowship

### Professional Affiliations

Tau Beta Pi, Phi Beta Kappa

### Skills

Solid and liquid phase peptide syntheses  
High pressure liquid chromatography (HPLC)  
Organic synthesis of novel amphiphiles

## **Kraig Haverstick**

Drug-polymer conjugation

Fourier Transform Infrared (FT-IR) spectroscopy

Nuclear Magnetic Resonance (NMR) spectroscopy

Langmuir-Blodgett techniques

Vesicle extrusion

Ultraviolet (UV) and fluorescence spectroscopy

### **Languages**

German